Joint Studies for Flow Apportionment

MAIN REPORT

Report of the International Souris-Red Rivers Engineering Board, Poplar River Task Force

FEBRUARY 1976

INTERNATIONAL SOURIS-RED RIVERS ENGINEERING BOARD

REGINA, SASKATCHEWAN, CANADA
WASHINGTON, D.C., UNITED STATES

International Joint Commission
Ottawa, Ontario, Canada
Washington, D.C, United States

February 27, 1976

Gentlemen:

The International Souris-Red Rivers Engineering Board, through its Poplar River Task Force, has completed the investigation and study necessary to advise the Commission on matters which it must consider in making a report to the Governments of Canada and the United States regarding an apportionment of the waters of the Poplar River Basin.

Attached hereto is a copy of the report prepared by the Board's Task Force. The Main Report is entitled "Joint Studies For Flow Apportionment - Poplar River Basin in Saskatchewan and Montana", and there are three appendices. The investigations summarized therein reflect the efforts of several agencies in Canada and the United States. The suggested apportionment and procedures for administering an apportionment agreement are contained in Chapter VIII and summarized in Chapter I of the Main Report. The Main Report also summarizes the background investigations that are presented in detail in the three appendices.

The Board wishes to draw to your attention the excellent work of the Task Force, supported by the agencies from which its members were drawn, in carrying out the necessary investigations and in preparing the attached report in a very limited time.

The Board concurs in the recommendations of its Task Force on the apportionment of waters of the Poplar River Basin and on the administration of that recommended apportionment.

The Board wishes to emphasize that the proposed apportionment formula defines a long-term solution to the sharing of the waters of the Poplar River between the United States and Canada, however it is felt that special arrangements are necessary for the filling period of the reservoir currently under construction on the East Poplar River by the Saskatchewan Power Corporation. Short term arrangements which would ensure early filling of the reservoir could hold advantages to both countries. With the reservoir filled to its operational level, Saskatchewan would be assured that the new power plant would be put "on stream" and Montana would be assured that regulated flows would be available during periods of need.

You will note from the report that the yield of the Poplar River varies markedly from year to year. The flows recorded in April and May of 1975, for example, would have filled the reservoir in weeks. On the other hand, a sequence of dry years would cause an extended filling period. Under average flow conditions the reservoir would take two years to fill to the safe operational capacity of 15,000 ac. ft. if the recommended apportionment formula were observed. Under the same conditions, the reservoir would fill to its full supply level of 32,000 ac. ft. in 4 to 5 years, assuming no power plant operation.

Saskatchewan and Montana are presently discussing interim arrangements for apportionment. Their discussions were initiated at a meeting between the United States Department of State and the Canadian Department of External Affairs on April 15, 1975.

If the apportionment formula recommended herein is adopted it would ultimately supersede the interim filling arrangements mentioned above. Therefore, it is recommended that the Commission discuss with Saskatchewan and Montana, the timing for transition from interim apportionment arrangements to final apportionment.

Although the question of water quality was not included in its Terms of Reference, the Board draws the Commission's attention to the fact that water quality was a consideration in forming the

recommendations of the Task [illegible] on the East Poplar [illegible] at the [illegible]. The Board emphasized the need for continuing examination of the water quality aspects.

The Board awaits further direction from the [illegible] matter.

Your [illegible],

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JOINT STUDIES

FOR

FLOW APPORTIONMENT

POPLAR RIVER BASIN

MONTANA - SASKATCHEWAN

MAIN REPORT

REPORT OF THE INTERNATIONAL SOUTH-RED [illegible]

ENGINEERING BOARD,

POPLAR RIVER TASK FORCE

FEBRUARY, 19[illegible]

REPORT OUTLINE

MAIN REPORT - Summary of studies, conclusions and recommendations regarding international apportionment of Poplar River flows.

APPENDIX A* - EXISTING AND HISTORICAL SURFACE WATER USE

Documentation of water use in the basin, and procedures and criteria for determining these uses.

APPENDIX B* - NATURAL FLOWS

Tabulations of reconstructed natural flows at selected key points in the basin and methodology for their computation.

APPENDIX C* - PROBABLE FUTURE WATER USE

Potential for future water use in the basin and estimates of location and quantity of possible future water requirements.

* Appendices A, B and C are bound separately in 3 volumes.

POPLAR RIVER TASK FORCE

HELENA, MONTANA, UNITED STATES
REGINA, SASKATCHEWAN, CANADA

International Souris-Red Rivers Engineering Board
Washington, D.C., United States
Regina, Saskatchewan, Canada

February 6, 1976

Gentlemen:

The Poplar River Task Force, established by your Board in April, 1975, and in accordance with your terms of reference, has completed the investigations and studies necessary for you to advise the International Joint Commission on matters which it must consider in making a report to the two Governments regarding an international flow apportionment agreement between Canada and the United States for the Poplar River Basin. The findings, conclusions and recommendations of the Task Force, together with a suggested procedure for Poplar River flow apportionment, are included in the attached report with its three appendices.

The investigations herein summarized reflect the efforts of several agencies in Canada and the United States. The suggested division of Poplar River surface water, a method of computing this flow division, and procedures for administering an apportionment agreement are contained in Chapter VIII and summarized in Chapter I of the Main Report. The Main Report also summarizes the background investigations that are presented in detail in the three appendices.

The Task Force now considers its charge, as stated in the terms of reference, to be completed and awaits further direction from the Board.

Yours sincerely,

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1 Attachment
Main Report and Appendices
(in four volumes)

MAIN REPORT

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I. APPORTIONMENT RECOMMENDATIONS

The Poplar River Task Force unanimously recommends that

A. The aggregate natural flow of all streams and tributaries in the Poplar River Basin crossing the international boundary shall be divided equally between Canada and the United States subject to the following conditions:

1. The total natural flow of the West Fork Poplar River and all its tributaries crossing the international boundary shall be divided equally between Canada and the United States but the flow at the international boundary in each tributary shall not be depleted by more than 60 percent of its natural flow.

2. The total natural flow of all remaining streams and tributaries in the Poplar River Basin crossing the international boundary shall be divided equally between Canada and the United States. Specific conditions of this division are as follows:

   a) Canada shall deliver to the United States a minimum of 50 percent of the natural flow of the Middle Fork Poplar River at the international boundary, as determined below the confluence of Goose Creek and Middle Fork.

   b) The delivery of water from Canada to the United States in the East Poplar River shall be determined on or about the first day of June of each year as follows:

      i) When the total natural flow of the Middle Fork Poplar River, as determined below the confluence of Goose Creek during the immediately preceding March 1 through May 31 period does not exceed 1,090 cubic decameters (1,000 acre-feet), then no obligation to deliver flow to

cubic metres per second (1.0 cubic feet per second) shall be delivered to the United States on the East Poplar River at the international boundary throughout the succeeding 12 month period commencing June 1st. In addition a volume of 370 cubic decametres (300 acre-feet) shall be delivered to the United States upon demand at any time during the 12 month period commencing June 1st.

ii) When the total natural flow of the Middle Fork Poplar River, as determined below the confluence of Goose Creek, during the immediately preceding March 1st to May 31st period is greater than 4,690 cubic decametres (3,800 acre-feet), but does not exceed 9,250 cubic decametres 7,500 acre-feet), then a continuous minimum flow of 0.057 cubic metres per second (2.0 cubic feet per second) shall be delivered to the United States on the East Poplar River at the international boundary during the succeeding period June 1st through August 31st. A minimum delivery of 0.028 cubic metres per second (1.0 cubic feet per second) shall then be maintained from September 1st through to May 31st of the following year. In addition, a volume of 617 cubic decametres (500 acre-feet) shall be delivered to the United States upon demand at any time during the 12 month period commencing June 1st.

iii) When the total natural flow of the Middle Fork Poplar River, as determined below the confluence of Goose Creek, during the immediately preceding March 1st to May 31st period is greater than 9,250 cubic decametres (7,500 acre-feet), but does not exceed 14,800 cubic decametres (12,000 acre-feet), then a continuous minimum flow of 0.085 cubic metres per second (3.0 cubic feet per second) shall be delivered to the United States on the East Poplar River at the international boundary during the succeeding period June 1st through August 31st. A minimum delivery of 0.057 cubic metres per second

(2.0 cubic feet per second) shall then be maintained from September 1st through to May 31st of the following year. In addition, a volume of 617 cubic decametres (500 acre-feet) shall be delivered to the United States upon demand at any time during the 12 month period commencing June 1st.

iv) When the total natural flow of the Middle Fork Poplar, as determined below the confluence of Goose Creek, during the immediately preceding March 1st to May 31st period exceeds 14,800 cubic decametres (12,000 acre-feet) then a continuous minimum flow of 0.085 cubic metres per second (3.0 cubic feet per second) shall be delivered to the United States on the East Poplar River at the international boundary during the succeeding period June 1st through August 31st. A minimum delivery of 0.057 cubic metres per second (2.0 cubic feet per second) shall then be maintained from September 1st through to May 31st of the following year. In addition, a volume of 1,230 cubic decametres (1,000 acre-feet) shall be delivered to the United States upon demand at any time during the 12 month period commencing June 1st.

c) The natural flow at the international boundary in each of the remaining individual tributaries shall not be depleted by more than 60 percent of its natural flow.

3. The natural flow and division periods for apportionment purposes shall be determined, unless otherwise specified, for periods of time commensurate with the uses and requirements of both countries.

B. A Board of Control be established to oversee the apportionment of waters and report on such matters that may be brought to the attention of the International Joint Commission. The recommendations on administration of apportionment and methods of calculation are contained in Chapter VIII.

Other Recommendations

Two important questions related to the matter of apportionment, but not specifically within the terms of reference, were brought to the attention of the Poplar River Task Force. These matters were concerned with interim apportionment during the filling period of the East Poplar Reservoir near Coronach and water quality.

The Poplar River Task Force unanimously recommends that consideration be given to the question of interim apportionment during the filling period of the East Poplar Reservoir near Coronach and that consideration of the water quality implications of the proposed apportionment be continued. Further discussion of these matters is found in Chapter IX.

II. INTRODUCTION

Background

Problems related to limited water supplies in the Poplar River Basin in Montana and Saskatchewan have existed since the area was settled in the late 1880's. Although not as severely affected during the major drought of the 1930's as were regions further west, this area did experience hardships caused by water shortages during the 1930's.

The Coronach and Clarks' Bridge Reservoirs on the East Poplar River and the West Poplar River Reservoir in Saskatchewan are the only major water storage facilities in the basin. A large number of small stockwatering ponds have been built in Montana and Saskatchewan since 1930.

Irrigation projects in the basin are usually limited to flood-plain lands, with most of the projects in Montana concentrated along the Poplar River and its main tributaries. In Saskatchewan, irrigation projects are of relatively smaller scale, with the majority of projects located in the East Poplar River subbasin.

On February 21, 1975, the Saskatchewan Power Corporation was authorized by the Saskatchewan Department of the Environment under the Provincial Water Rights Act to construct a dam to create a 39,000 cubic decameter (32,000 acre-feet) reservoir on the East Poplar River approximately 3.2 kilometres (2 miles) upstream of the international boundary. This authorization included the use of East Poplar River water to assist in developing the thermal power potential of the lignite coal deposits located to the west of the Town of Coronach along Girard Creek. Since the East Poplar River is an international river, it is subject to the International River Improvements Act of Canada. A licence to build a dam and impound water on the East Poplar was issued to the Saskatchewan Power Corporation on April 30, 1975 by Environment Canada subject to several terms and conditions including the limitations resulting from future international water apportionment to the

Poplar River Basin. Since this project will reduce downstream water supplies in Montana, the United States Government brought this concern to the Government of Canada on February 10, 1975.

It was recognized that Canada and the United States should each have the right to independently develop their water resources. In view of the very limited surface runoff in the basin, it is obvious that water related development has definite limits. Therefore, an apportionment agreement should consider the nature and magnitude of existing and future water demands in the basin and should be directed toward the efficient and beneficial use of Poplar River water for both countries.

The International Joint Commission, on April 8, 1975 under the reference dated January 12, 1948, instructed the International Souris-Red Rivers Engineering Board to proceed with investigations leading to recommendations on equitable apportionment of the waters of the Poplar River Basin.

Poplar River Task Force

To undertake and report on the Poplar River investigations, the International Souris-Red Rivers Engineering Board, with the approval of the Commission, appointed an international Poplar River Task Force.

Terms of Reference

The Poplar River Task Force was asked to make recommendations on:

1. An equitable apportionment at the international boundary of the flows of the Poplar River Basin,

2. A method of calculation of natural flows in the Poplar River Basin at the international boundary, and

3. The membership and terms of reference for an international group to administer an apportionment agreement.

Studies were to consider water use and flow on all main branches and tributaries of the Poplar River and to arrive at an equitable division

of flow at the international boundary. The direction of flow across the international boundary is from Canada to the United States and therefore specific reference is made to major tributaries in Canada and cross, or contribute to streamflow crossing the international boundary into the United States.

The following steps were involved in carrying out the study:

a. Evaluate historical and existing levels of surface water use in the watershed.

b. Reconstruct sequences of natural flow data in the basin that would have occurred without the effect of man's influence on the flow regime.

c. Identify probable future water use in the basin.

d. Evaluate various apportionment alternatives in order to identify the most desirable and mutually acceptable solution to the division of waters of the Poplar River at the international boundary.

e. Develop a method of calculating natural flows at the international boundary to facilitate administration of flow apportionment.

f. Define membership and terms of reference for international administration of an apportionment agreement.

Membership

The members of the Task Force were drawn from agencies of governments of Canada, United States, Montana and Saskatchewan. The agencies represented by the members of the Task Force and their alternates (Table 1) were responsible for carrying out the specific components of the apportionment study.

Table 1: Membership and Government Affiliation, Poplar River Task Force, 1975-76.

Task Force

Bill Christiansen, Lieutenant-Governor, State of Montana
D. A. Davis, Environment Canada (Chairman, Canadian Section)
R. B. Godwin, Canada Department of Regional Economic Expansion
R. L. McPhail, U.S. Bureau of Reclamation
G. C. Mitchell, Saskatchewan Department of the Environment
G. M. Pike, U.S. Geological Survey (Chairman, United States Section)

Secretaries

J. M. Dooley, U.S. Bureau of Reclamation
T. K. Olson, Saskatchewan Department of the Environment

Task Force Alternates[4]

D. R. Cuthbert, Environment Canada
J. M. Dooley, U.S. Bureau of Reclamation
O. A. Ferris, Montana Department of Resources and Conservation
C. O. Geiger, U.S. Geological Survey
J. R. Hart, Saskatchewan Department of the Environment

[4] Other study contributors are acknowledged in appropriate appendices

III. BASIN DESCRIPTION

The Poplar River, a tributary of the Missouri River, [illegible] southern Saskatchewan to northeastern Montana and has a gross drainage area of 8,622 square kilometres (3,329 sq.mi.). Approximately 37 percent of the basin, or 3,149 square kilometres (1,216 sq.mi.), is located in Canada with the remaining 5,473 square kilometres (2,113 sq.mi.) in the United States (Figure 2).

Physical Features

The drainage area of the Poplar River is shaped like an inverted pear with its major tributaries rising from the southeast portion of Wood Mountain and areas to the east of Wood Mountain in Saskatchewan. The drainage area narrows from a maximum width of about 100 kilometres (60 miles) at the international boundary to the river's mouth near Poplar, Montana, a distance of some 115 kilometres (70 miles). The Poplar has three principal branches, each of which originates in Canada. The East Poplar River with a basin area of 1,205 square kilometres (749 sq.mi.) joins the Middle Fork Poplar River (937 sq.km. or 582 sq.mi.), the Canadian portion of which is called the Poplar River, to form the main stem about three kilometres (2 miles) north of Scobey in Montana. The West Fork Poplar River (1,627 sq.km. or 1,010 sq.mi.), known as the West Poplar River in Canada, meets this main stem roughly midway between Scobey and Poplar, Montana. A portion of the East Poplar headwaters drain into Fife Lake in Saskatchewan. Overflow from this natural lake occurs about once in ten years, a factor which effectively eliminates approximately 414 square kilometres (257 sq.mi.) from the drainage area of the East Poplar in most years. The gross and effective drainage areas for all tributaries of the Poplar are presented in detail in Appendix B, Table B-1.

The topography of the Poplar River Basin is level to gently rolling, with soils ranging from sandy and clay loam over glacial till in the uplands to more fertile alluvium in the river valleys. The lower portion of the Middle Fork and the main stem of the Poplar below Scobey pass through valleys varying in width from two to four miles. Other tributary streams including the West Fork and East Poplar are located in smaller and narrow valleys. Due to the semi-arid climate of this region (mean annual precipitation of 30 to 40 centimetres or 12 to 16 inches) these river valleys and the surrounding prairie have developed as natural grasslands.

Social and Economic Features

Approximately seven to eight thousand people live in the Poplar River Basin, of which roughly two-thirds are United States' citizens. Settlement in the basin is predominantly rural with several small urban service centres. The largest of these centres are Rockglen (population 524) and Coronach (300) in Saskatchewan, and Poplar (1,400) and Scobey (1,500) in Montana. The Fort Peck Indian Reservation, residence of the Sioux and Assiniboine Tribes in Montana, encompasses about 1,450 square kilometres (900 sq.mi.) of the watershed, representing the lower third of the basin. Agricultural practices dominate the economy of the region with cereal crops, fodder crops and ranching the main interests.

Due to the technical nature of this investigation, public meetings and attitude surveys did not form a part of the study. However the study group was aware of a concern on the part of basin residents over the lack of water in the basin. Concerns of this nature were expressed by representatives of the Fort Peck Indian Tribes at several meetings of the Task Force. The Tribes have tentative plans for a major irrigation program in the watershed (Appendix C) which could utilize a large portion of the flows of the Poplar River.

Surface Water Features

The long-term average annual discharge of the Poplar River near its mouth is 3.77 cubic metres per second (133 cubic feet per second), but flows vary considerably on a seasonal basis and from year to year. For example, in

38 years of record at the stream gauging station near [illegible], Montana, the mean annual flow has varied from 12.37 m³/s (437 cfs) in [illegible] (20 cfs) in 1934. Fall or winter flows below 0.14 m³/s (5 cfs) occur with periods of no flow occurring at times, while spring (snowmelt runoff) has exceeded 1050 m³/s (37,000 cfs). The Poplar River normally reaches its peak in April or May from runoff caused by snowmelt or snowmelt augmented by rainfall. The peak rapidly diminishes thereafter with sustained summer flow of the Poplar in the range of 0.28 to 0.56 m³/s (10 to 20 cfs).

The long term average annual, minimum annual and maximum annual natural discharges of the Poplar River and its major tributaries, as defined by available recorded and synthesized runoff data, are summarized in Table [illegible]. It is apparent from the average annual yields per unit area, that the low-water tributaries of the Middle Poplar River and East Poplar River in Saskatchewan contribute significantly to streamflow in Montana. Extended periods of low or zero flow occur in the Poplar River and its tributaries particularly in the fall and winter months.

It is difficult to make adequate generalizations about the quality of water in the Poplar River or its tributaries considering the short periods in which water quality has been monitored (monitoring in the basin was begun in December, 1974).

Available data indicates that water quality conditions are most critical during summer low-flow periods, except for dissolved oxygen which is depleted during winter ice cover periods. Parameters that could interfere with or detract from existing uses of Poplar River water include boron, manganese, sodium, sulfate and total dissolved solids, as well as temperature, dissolved oxygen and pH. These parameters approach upper critical limits for irrigation and aquatic production. During 1975 concentrations of boron on the [illegible] River ranged from 3.1 mg/ℓ in mid-summer to 1.0 mg/ℓ during winter runoff. These concentrations of boron and other constituents may have been smaller than normal because Fife Lake experienced overflow conditions for the first time in 20 years.

Table 2: Long Term Average Annual, Minimum Annual and Maximum Annual Natural Flows of the Poplar River and Related Yields per Unit Area

Location	Area	Average Annual Flow	Average Annual Yield	Minimum Annual Flow	Minimum Annual Yield	Maximum Annual Flow	Maximum Annual Yield
	sq.km (sq.mi.)	dam^3 (ac-ft)	dam^3/km^2 (ac-ft/mi^2)	dam^3 (ac-ft)	dam^3/km^2 (ac-ft/mi^2)	dam^3 (ac-ft)	dam^3/km^2 (ac-ft/mi^2)
West Fork Poplar R. at int'l bdry.	376.6 (145.4)	4,686 (3,799)	12.4 (26.1)	142 (115)	0.4 (0.8)	24,991 (20,260)	66.4 (139.3)
West Fork Poplar R. near Four Buttes	2,615.9 (1,010.0)	30,152 (24,444)	11.5 (24.2)	5,843 (4,737)	2.2 (4.7)	112,510 (91,212)	43.0 (90.3)
Middle Fork Poplar R. at int'l bdry.	927.2 (358.0)	15,987 (12,961)	17.2 (36.2)	2,890 (2,343)	3.1 (6.5)	54,210 (43,948)	58.5 (122.8)
Middle Fork Poplar R. near Scobey	1,506.3 (581.6)	26,376 (21,383)	17.5 (36.8)	4,618 (3,744)	3.1 (6.4)	89,247 (72,353)	59.3 (124.4)
East Poplar R. at int'l bdry.	737.1 * (284.6)*	15,388 (12,475)	20.9 (43.8)	3,260 (2,643)	4.4 (9.3)	57,717 (46,791)	78.3 ** (164.4)**
East Poplar R. near Scobey	1,247.3 * (481.6)*	23,652 (19,175)	19.0 (39.8)	4,474 (3,627)	3.6 (7.5)	83,007 (67,294)	66.6 ** (139.7)**
Poplar R. near Poplar	7,489.2 * (2,891.6)*	114,169 (92,560)	15.2 (32.0)	17,777 (14,412)	2.4 (5.0)	410,678 (332,937)	54.8 ** (115.1)**

*Excluding gross drainage area of Fife Lake which does not contribute to East Poplar flows in most years.

**Overflow from Fife Lake may cause these figures to be slightly high relative to maximum annual yields on other tributaries.

At the present time water quality appears to be seasonally acceptable or marginally acceptable for agriculture use due to high concentrations of boron and total dissolved solids. Temperature, dissolved oxygen and total dissolved solids approach critical limits for aquatic uses. Further deterioration of water quality could seriously impair existing or future uses in the basin.

IV. ORGANIZATION OF STUDY

The plan of study basically provided for inventory of existing and historical surface water use, definition of natural flow, identification of probable future water use in the Poplar River Basin, and an assessment of flow apportionment alternatives. Most information on existing water use had to be gathered by field and basin resident surveys in both Canada and the United States. The study effort and expenditures specifically directed toward the report were shared roughly equally by the two countries. Agencies of the State of Montana and the Province of Saskatchewan assumed a significant role in this effort.

Existing and Historical Surface Water Use

To provide information on which to base computations of natural flow and decisions regarding division of flow, it was necessary to determine existing and historical water use in the basin. The existing water use inventory was based on 1975 levels of surface water use in the basin. The historical uses inventory encompassed the period 1931 to 1974.

A statement on the legal aspects of water rights in Saskatchewan and the United States, with special emphasis on Federally Reserved rights, was included in Appendix A.

Water rights permits and records were researched in Montana and Saskatchewan to provide a guide to actual use patterns. To supplement and/or verify documentation of the existing and historical water uses, extensive field investigations were carried out. Aerial photographs were examined to identify locations and sizes of stockwatering ponds and irrigated areas. Basin residents were interviewed to establish both the historical and existing levels of water use. These studies are fully elaborated upon in Appendix C.

Natural Flow

To fully assess the quantity of surface water that is available in the Poplar River Basin, natural flows adjusted for consumptive uses were reconstructed or synthesized at six locations (see Appendix B). These key points where some historical streamflow records are available are listed below:

1. West Fork Poplar River at international boundary
2. Middle Fork Poplar River at international boundary
3. East Poplar River at international boundary
4. East Poplar River near Scobey, Montana
5. Middle Fork Poplar River near Scobey, Montana
6. Poplar River near Poplar, Montana

Streamflow data in the form of monthly mean flows at these sites were adjusted by adding the effect of upstream water use to represent natural flow conditions. These flow sequences were then extended as necessary by statistical methods to the base period of 1931 to 1974.

To provide additional information on the flow regime of the watershed, natural flows were mathematically reconstructed or synthesized for the 1931 to 1974 period at the following locations:

1. Coal Creek at international boundary
2. Coal Creek near Four Buttes, Montana (Mouth of Creek)
3. East Tributary of West Fork Poplar River at international boundary
4. Cow Creek at international boundary
5. West Fork Poplar River near Four Buttes, Montana
6. Poplar River near Kahla, Montana

These data were further supplemented and/or supported by data from stream gauges that were re-established or newly installed during the late spring of 1975 at the following locations:

1. West Fork Poplar River at international boundary
2. East Poplar River at Coronach Dam Site
3. Cow Creek near international boundary

4. East Poplar River near Scobey, Montana
5. Middle Fork Poplar River near Scobey, Montana
6. Poplar River near Poplar, Montana

Probable Future Use

To provide an insight into probable future water use in the basin, an assessment of firm plans, permits, and intents to use water in Montana and Saskatchewan during the period 1976 through 1985 was made. In addition, presently identified future uses beyond 1985 were catalogued. Information concerning probable future water use in the Fort Peck Indian Reservation was provided by the Fort Peck Tribal Council through Morrison-Maierle Inc., consulting engineers. Results of the sector study are contained in Appendix F.

Assessment of Flow Apportionment Alternatives

A method of assessing alternative flow apportionment schemes was developed to assist in evaluating their potential effect on the flow regime in the Poplar River Basin. The mathematical natural flow model for the basin was used to define the effect of the various apportionment alternatives on monthly mean flow at the synthesized and key points.

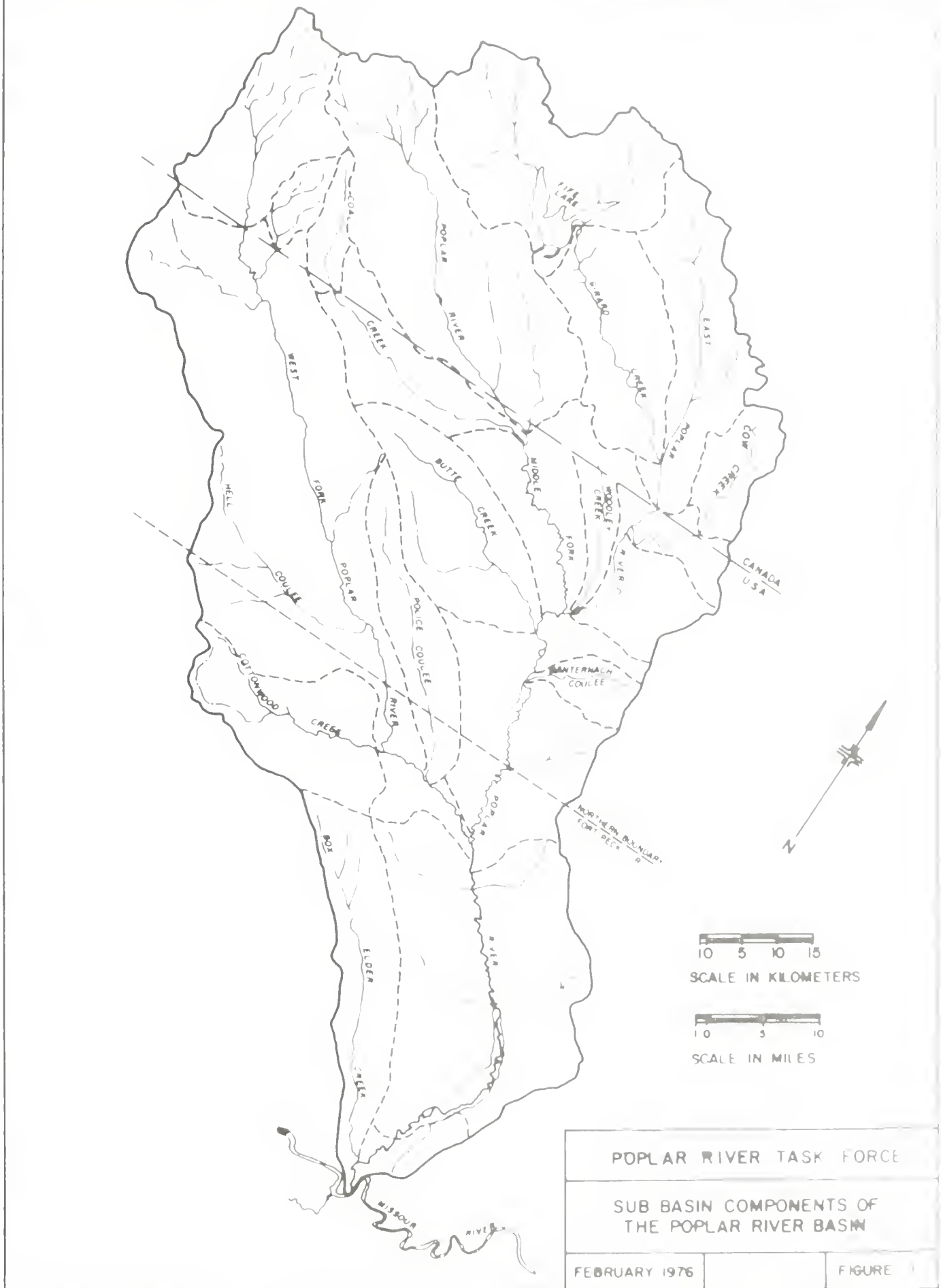
V. EXISTING AND HISTORICAL SURFACE WATER USE

Existing and historical surface water uses in the Poplar River Basin were estimated and documented based on 1975 and 1931 to 1974 levels of water use. The average annual uses at 1975 or existing levels of development in the Montana and Saskatchewan portions of the basin are estimated to be 10,720 cubic decametres (8,690 acre-feet) and 1,920 cubic decametres (1,560 acre-feet) respectively, for a total of 12,640 cubic decametres (10,250 acre-feet). The historical (1931 to 1974) annual uses in Montana have varied from a minimum of 1,979 cubic decametres (1,604 acre-feet) in the year 1934 to a maximum of 10,596 cubic decametres (8,590 acre-feet) in 1972. In Saskatchewan, the corresponding use estimates are 11 cubic decametres (nine acre-feet) in 1932 and 1933, and 4,675 cubic decametres (3,790 acre-feet) in 1958. This water use data accounts for irrigation, stockwatering, municipal, domestic and industrial uses. The existing use estimates incorporate surface evaporation rates in reservoirs for an average year. A detailed description of the investigation procedures, criteria and assumptions on which the information in this chapter is based is presented in Appendix A.

A total of 897 projects were identified in the Poplar River Basin during this study. The types of projects identified, and their locations by subbasin (Figure 1) are summarized in Table 3.

Existing Surface Water Use

The quantity of surface water used in the Poplar River Basin for stockwatering and irrigation varies annually and is dependent upon the number of projects in operation. Conditions that dictate the operation or non-operation of a project, as well as the quantity of water use, include variations in annual precipitation, antecedent soil moisture content, evaporation, water quality and the availability of water in the rivers.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10 5 10 15
SCALE IN KILOMETERS
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SCALE IN MILES
POPLAR RIVER TASK FORCE
SUB BASIN COMPONENTS OF
THE POPLAR RIVER BASIN
FEBRUARY 1976
FIGURE

Table 3: Number and Type of Water Use Projects in the Poplar River Basin

	Number of Projects			
	Domestic	Irrigation	Municipal	Total
Sub-basin (Saskatchewan)				
1. Cow Creek	10	2	0	12
2. East Poplar River	43	11	0	54
3. Girard Creek	20	7	1	28
4. Fife Lake	48	11	0	59
5. Poplar River	38	3	0	41
6. Coal Creek	2	0	0	2
7. East Tributary of West Poplar River	6	2	0	8
8. West Poplar River	14	3	0	17
9. Other Canadian Tributaries	3	1	0	4
Sub-Total - Saskatchewan	184	40	1	225
Sub-basin (Montana)				
International Boundary to Fort Peck Indian Reservation Boundary				
10. Cow Creek	3	0	0	3
11. East Poplar River	22	7	0	29
12. Woodley Creek	8	3	0	11
13. Middle Fork Poplar River	11	6	0	17
14. Coal Creek	33	1	0	34
15. West Fork Poplar River	158	5	0	163
16. Poplar River Main Stem	34	12	1	47
17. Butte Creek	46	3	0	49
18. Manternach Coulee	5	4	0	9
19. Police Coulee	(in W. Fork)	3	0	3
Sub-Total	320	44	1	365
Fort Peck Indian Reservation to Mouth				
20. Poplar River to West Fork	24	3	0	27
21. West Fork Poplar	33	2	0	35
22. Cottonwood Creek	40	0	0	40
23. Police Creek	3	1	0	4
24. Poplar River, West Fork to USGS Gauge 6-1810	135	9	0	144
25. Poplar River, USGS Gauge 6-1810 to Missouri River	7	2	0	9
26. Box Elder Creek	48	0	0	48
Sub-Total	290	17	0	307
TOTAL - POPLAR RIVER BASIN	794	101	2	897

Of the estimated total of [illegible] cubic decametres [illegible] for feet) for the existing or 1975 level of water use in the basin, [illegible] requirements account for 23 per cent and crop irrigation for 6[illegible] per cent. The balance is accounted for by evaporation from large reservoirs, and [illegible] municipal uses. Domestic water uses include consumption by [illegible] as surface evaporation from the many small storage reservoirs throughout the basin. The crops in the basin which require irrigation are generally alfalfa, native hay and altalfa-grass hay mixtures, which provide winter feed for livestock. Coronach, Saskatchewan and Scobey, Montana draw water from wells adjacent to Girard Creek and the main stem of the Poplar River respectively, accounting for all of the municipal use. Water is not presently used for industrial purposes in the watershed, although several potential requirements in this classification are proposed for the future as discussed in Chapter [illegible].

Surface water use in the 26 subbasin components of the Poplar River Watershed for the 1975 level of development are summarized in Table [illegible].

Historical Surface Water Use

Historical water use in the Poplar River Basin has, as can be expected, increased significantly from the estimated total use of [illegible],229 cubic decametres (1,807 acre-feet) in 1931. In Montana, the maximum historical use of 10,596 cubic decametres (8,590 acre-feet) in 1972 reflects the trend of increased beef cattle production and the related demand for winter feed crops, which require some degree of irrigation. In Saskatchewan, surface water use for irrigation and domestic purposes has also exhibited a continuous upward trend from 1931 to 1974. The maximum usage of [illegible],67[illegible] cubic decametres (3,790 acre-feet) in 1958, followed by a reduction [illegible] use in subsequent years does not clearly reflect this increased use [illegible] surface evaporation from large reservoirs is included in the historical estimates. A decrease in surface evaporation on large reservoirs since 1958 (Appendix A, Table A-5), due in part to the reduction of Fort Peck Reservoir storage capacity, is the cause of this net reduction in historical water use.

Table 4a: Existing (1975 Level) Surface Water Use in the Poplar River Basin (Cubic Decametres)

	Domestic Use	Domestic Evap.	Irrigation Use	Irrigation Evap.	Municipal	Mean Evap. on Large Reservoirs	Total
Sub-basin (Saskatchewan)							
1. Cow Creek	10	17	0	0	0	0	27
2. East Poplar River	30	100	75	0	0	185	390
3. Girard Creek	25	136	49	55	44	296	606
4. Fife Lake	63	84	79	15	0	0*	240
5. Poplar River	59	96	64	0	0	0	220
6. Coal Creek	6	6	0	0	0	0	12
7. East Tributary of West Poplar River	10	2	16	0	0	0	28
8. West Poplar River	20	25	15	0	0	284	343
9. Other Canadian Tributaries	2	30	25	0	0	0	57
Sub-Total - Saskatchewan	224	496	323	70	44	765	1923
Sub-basin (Montana)							
International Boundary to Fort Peck Indian Reservation Boundary							
10. Cow Creek	11	5	0	0	-		16
11. East Poplar River	32	51	667	0	-		750
12. Woodley Creek	11	14	465	0	-		490
13. Middle Fork Poplar River	48	21	2405	0	-		2474
14. Coal Creek	37	33	32	0	-		102
15. West Fork Poplar River	244	192	954	0	-		1390
16. Poplar River Main Stem	69	75	1849	432	-		2425
17. Butte Creek	69	149	202	0	-		420
18. Manternach Coulee	11	17	384	0	-		412
19. Police Coulee	(in W. Fork Total)		194	0	-		194
Sub-Total	532	557	7152	432	-		8673
Fort Peck Indian Reservation to Mouth							
20. Poplar River to West Fork	21	46	522	0	-		589
21. West Fork Poplar	48	61	48	0	-		157
22. Cottonwood Creek	63	76	0	0	-		139
23. Police Creek	6	10	31	0	-		47
24. Poplar River, West Fork to to USGS Gauge 6-1810	153	412	246	0	-		811
25. Poplar River, USGS Gauge 6-1810 to Missouri River	10	7	102	0	-		119
26. Box Elder Creek	57	128	0	0	-		185
Sub-Total	358	740	949	0	-		2047
TOTAL - POPLAR RIVER BASIN	1114	1793	8494	476	765		12643

*Existing uses in the Fife Lake basin have offset the effect of the control on Fife Lake and the lake has been close to its natural level in recent years.

Table 4b: Existing (197x level) Future Water Use in the Poplar River Basin (acre-feet)

	Domestic Use	Domestic Evap.	Irrigation Use	Irrigation Evap.	Municipal	Mean Evap. on Large Reservoirs	Total
Sub-basin (Saskatchewan)							
1. Cow Creek	8	14	0	0	0	0	22
2. East Poplar River	24	81	61	0	0	150	316
3. Girard Creek	20	110	40	45	36	240	491
4. Fife Lake	51	68	64	12	0	0*	195
5. Poplar River	48	78	52	0	0	0	178
6. Coal Creek	5	5	0	0	0	0	10
7. East Tributary of West Poplar River	8	2	13	0	0	0	23
8. West Poplar River	16	20	12	0	0	230	278
9. Other Canadian Tributaries	2	24	20	0	0	0	46
Sub-Total - Saskatchewan	182	402	262	57	36	620	1559
Sub-basin (Montana)							
International Boundary to Fort Peck Indian Reservation Boundary							
10. Cow Creek	9	4	0	0	-		13
11. East Poplar River	26	41	541	0	-		608
12. Woodley Creek	9	11	377	0	-		397
13. Middle Fork Poplar River	39	17	1950	0	-		2006
14. Coal Creek	30	27	26	0	-		83
15. West Fork Poplar River	198	156	773	0	-		1127
16. Poplar River Main Stem	56	61	1499	350	-		1966
17. Butte Creek	56	121	164	0	-		341
18. Manternach Coulee	9	14	311	0	-		334
19. Police Coulee	(in W. Fork Total)		157	0	-		157
Sub-Total	432	452	5798	350	-		[illegible]
Fort Peck Indian Reservation to Mouth							
20. Poplar River to West Fork	17	37	423	0			[illegible]
21. West Fork Poplar	39	49	39	0	-		[illegible]
22. Cottonwood Creek	51	62	0	0	-		113
23. Police Creek	5	8	25	0			38
24. Poplar River, West Fork to to USGS Gauge 6-1810	124	334	199	0	-		[illegible]
25. Poplar River, USGS Gauge 6 1810 to Missouri River	8	6	83	0			[illegible]
26. Box Elder Creek	46	104	0	0			[illegible]
Sub-Total	290	600	769	0	-		[illegible]
TOTAL - POPLAR RIVER BASIN	904	1454	6886	386	620		[illegible]

* Existing uses in the Fife Lake basin have offset the effect of the control on Fife Lake and the lake has been close to its natural level in recent years.

Data for total historical water use in the 26 subbasin components of the Poplar River Basin for the period 1931 to 1974 are listed in Table 5. A more detailed breakdown of these total uses into domestic, irrigation, large reservoir evaporation and municipal uses is presented in Appendix A.

Water Rights

Concern for the protection of reserved water rights of the Fort Peck Tribes was brought to the attention of the Task Force. In Appendix A, the Task Force noted that legal questions do exist relating to water rights and permits in both Canada and the United States. The Task Force views these legal questions, including protection of United States Federal reserved water rights, as internal matters to be resolved within the respective countries. The discussion in Appendix A includes mention of water law in Canada, United States Federal reserved water rights, and Montana State water law.

Table 5. Total Historical [illegible] Water Use [illegible]

Year	Historical Water Use in Saskatchewan		Historical water use in Montana	
	cubic decametres	acre feet	cubic decametres	acre feet
1931	14	11	2,21[illegible]	1,79[illegible]
1932	11	9	3,57[illegible]	2,[illegible]
1933	11	9	3,3[illegible]	2,[illegible]
1934	17	14	1,979	1,60[illegible]
1935	49	40	4,013	3,253
1936	58	47	2,938	2,382
1937	148	120	2,173	1,762
1938	160	130	2,785	2,258
1939	271	220	3,159	2,560
1940	247	200	3,232	2,62[illegible]
1941	247	200	3,271	2,65[illegible]
1942	210	170	3,332	2,701
1943	296	240	4,042	3,227
1944	247	200	3,454	2,80[illegible]
1945	247	200	2,972	2,409
1946	247	200	2,362	1,915
1947	234	190	3,525	2,858
1948	592	480	3,555	2,882
1949	678	550	2,960	2,400
1950	481	390	3,736	3,029
1951	771	630	3,314	2,687
1952	3,281	2,660	3,419	2,772
1953	1,875	1,520	4,936	4,002
1954	1,813	1,470	4,294	3,481
1955	3,195	2,590	4,606	3,734
1956	3,738	3,030	4,628	3,752
1957	3,491	2,830	4,069	3,299
1958	4,675	3,790	3,473	2,816
1959	3,343	2,710	3,428	2,779
1960	3,096	2,510	5,504	4,462
1961	4,342	3,520	4,755	3,855
1962	2,319	1,880	8,314	6,740
1963	2,196	1,780	8,62[illegible]	6,993
1964	3,182	2,580	7,05[illegible]	5,723
1965	2,023	1,640	8,769	7,109
1966	2,294	1,860	7,21[illegible]	5,8[illegible]
1967	1,875	1,520	9,67[illegible]	7,841
1968	2,072	1,680	[illegible],593	6,15[illegible]
1969	1,887	1,530	[illegible],87[illegible]	6,38[illegible]
1970	1,863	1,510	9,91[illegible]	8,038
1971	2,368	1,920	8,188	6,638
1972	2,060	1,670	10,590	8,5[illegible]0
1973	1,912	1,550	8,385	6,773
1974	1,678	1,3[illegible]	8,7[illegible]	7,13[illegible]

VI. NATURAL FLOWS

Natural streamflow data represents the flow that would have occurred in rivers and streams without the influence of man on the flow regime. Natural streamflows at selected locations in the Poplar River Basin were estimated to assess the amount of water available for use in the watershed, and to provide a data base which could be used to evaluate the impacts of alternative apportionment schemes on existing and future water use in the basin. In addition, the administration of any future water apportionment agreement will entail natural flow computations at the international boundary crossings on some or all of the major branches of the Poplar.

Natural streamflow data in the basin were estimated on a monthly mean basis. The definition of natural flows for time periods shorter than one month could not be justified for the purposes required in the study, and more detailed historical water use information is not available.

Natural Flow Study Points

Natural flows were estimated at 12 locations in the basin. Six international boundary locations were selected to provide information on natural flows rising in the Canadian portion of the basin. Natural flows were identified at the remaining downstream locations in Montana to provide a basis for evaluating the effect of flow apportionment alternatives on water availability in Montana. These natural flow study points are listed below:

International Boundary Sites

1. West Fork Poplar River at international boundary
2. Middle Fork Poplar River at international boundary
3. East Poplar River at international boundary
4. Coal Creek at international boundary
5. Cow Creek at international boundary
6. East tributary of West Fork Poplar River at international boundary

Montana Sites

1. East Poplar River near Scobey, Montana
2. Middle Fork Poplar River near Scobey, Montana
3. Poplar River near Poplar, Montana
4. Coal Creek near Four Buttes, Montana
5. West Fork Poplar River near Four Buttes, Montana
6. Poplar River near Kahla, Montana

Computational Methodology

For the six locations where some recorded streamflow data were available, natural mean monthly streamflows for the period 1931 to 197- were defined as follows:

1. Natural flows for the period of record were obtained by adding the estimated historical consumptive uses to the recorded flows in the months when depletions were known to occur.

2. When streamflow records were not available, March to October natural flows were estimated using statistical regression equations. Natural flows for recorded periods were related to similar flows at several adjacent long term hydrometric stations. The best statistical relationship was then used to fill in missing monthly records.

3. Where recorded winter streamflow data (November through February) were not available, estimates of natural flows were based on technical criteria that varied with, and were dependent on the site location. In all cases, the estimated winter flows were very small in size.

4. At locations where streamflow regulation occurs through storage of water in major reservoirs, the necessary adjustments to flows were based on simulated operation of the reservoirs.

The procedures followed in estimating these natural flows and the assumptions that were made during the study are presented in detail in

Estimates of natural flow at the six locations where recorded streamflow data are not available were based on natural flows defined at nearby Poplar River sites which have stream gauge data. In general, these natural flow estimates were determined using ratios of effective drainage areas at the gauged and ungauged sites. Where necessary, adjustments were made in the winter flows to more accurately reflect natural flow conditions to the smaller tributaries.

Results

Annual natural flows at the 12 selected locations in the Poplar River Basin are listed in Table 6 for the 1931 to 1974 study period. Estimates of natural monthly mean flows at these locations are tabulated in Appendix B.

The total annual flow of the Poplar River Basin at the international boundary averages 42,000 cubic decametres (34,000 acre-feet). The maximum annual flow is 160,000 cubic decametres (130,000 acre-feet) and the minimum annual flow is 6,950 cubic decametres (5,600 acre-feet). Some 85% of the flow at the boundary is measured in the three main tributaries; 36% in the East Poplar River, 38% in the Middle Fork Poplar River and 11% in the West Fork Poplar River.

The Middle and West Forks are more variable than the East Poplar, tending to have high spring and low to zero flows in late summer and fall. The East Poplar, on the other hand, usually maintains some base flow for most months of the year. A similar pattern is repeated at downstream stations. Even at Poplar River near Poplar, the late fall and winter flows frequently fall below 0.14 cubic metres per second (5 cfs).

Table 6a: Annual Natural Flows in Cubic Decametres at Selected Locations in the Poplar River Basin

YEAR	West Fork Poplar R at Int'l Bdry	*East Tributary, West Poplar at Int'l Bdry	* West Fork Poplar R near Four Buttes, Mont	* Coal Creek at Int'l Bdry	* Coal Creek near Four Buttes, Mont	Middle Fork Poplar R at Int'l Bdry	*Middle Fork Poplar R near Scobey, Mont	East Poplar R at Int'l Bdry	* Crow Creek at Int'l Bdry	East Poplar R near Scobey, Mont	* Poplar River near Ft. Peck, Mont	Poplar River near Poplar, Mont
1931	303	56	7,770	59	846	2,890	4,620	3,280				
1932	755	138	10,400	148	1,970	6,410	10,200	9,700	1,180			
1933	2,350	424	18,700	455	3,750	11,500	18,600					
1934	2,920	533	34,100	571	3,440	9,930	15,900					
1935	370	67	7,640	72	2,040	6,840	11,300					
1936	2,030	371	13,700	398	3,380	10,300	16,800					
1937	257	46	5,840	49	1,020	3,310	5,370					
1938	3,600	660	23,800	707	4,520	13,300	21,800					
1939	11,800	2,160	70,400	2,320	10,100	27,100	45,000					
1940	1,570	287	12,200	307	2,670	8,180	13,500	8,450	981			
1941	2,020	368	11,600	393	4,080	12,800	20,600	12,300				
1942	1,540	279	12,600	299	2,820	8,830	14,400					
1943	7,110	1,510	67,700	1,620	12,900	39,800	63,200					
1944	1,090	201	12,000	215	17,600	6,890	11,400					
1945	2,960	543	25,100	581	3,140	8,840	14,600					
1946	2,290	419	11,100	449	2,400	6,710	14,900					
1947	1,390	254	18,700	271	4,160	14,300	22,800					
1948	4,660	854	29,500	914	15,300	19,300	31,300					
1949	482	86	7,680	93	1,840	6,040	9,880	9,95				
1950	11,300	2,080	58,000	2,230	5,960	22,300	37,400					
1951	7,140	1,310	41,800	1,400	4,860	12,200						
1952	25,000	4,590	113,000	4,920	20,500	54,200						
1953	3,460	629	29,800	675	6,690	21,100	33,900					
1954	18,400	3,360	89,000	3,600	16,200	45,800						
1955	10,600	1,940	58,800	2,080	12,400	36,000						
1956	3,000	548	22,800	587	3,560	10,200	17,400					
1957	724	131	10,600	139	1,560	4,89						
1958	3,530	645	21,300	691	4,210	12,500						
1959	1,180	212	13,000	227	1,500	4,370						
1960	5,920	1,090	40,300	1,160	8,310	24,900						
1961	142	25	7,140	26	1,000	3,290						
1962	3,830	698	24,300	748	5,060	14,800						
1963	6,730	1,230	49,100	1,320	12,000	37,000						
1964	1,200	220	12,600	236	1,810	5,350						
1965	1,670	305	16,800	321	2,420	7,270						
1966	2,230	407	20,200	437	3,250	9,510						
1967	9,600	1,760	51,400	1,880								
1968	4,280	782	31,600	838	5,460	15,700						
1969	12,800	2,350	61,700	2,520	11,000							
1970	5,140	939	36,300	1,000	6,230							
1971	2,450	449	17,600	480	2,870	8,240						
1972	3,930	719	31,400	770	6,630							
1973	1,040	191										
1974	10,100	1,850										
Minimum	142	25		26	846	2,890						
Maximum	25,000	4,590		4,920	20,500							
Mean	4,690	857		919	6,070							

* Synthesized Flows as compared to other locations which had some recorded data although not necessarily for the complete period of record

Table 6b: Annual Natural Flows in Acre Feet at Selected Location in the Poplar River Basin

YEAR	West Fork Poplar R. at Int'l Bdry.	*East Tributary, West Poplar at Int'l Bdry.	* West Fork Poplar R. near Four Buttes, Mont.	* Coal Creek at Int'l Bdry.	*Coal Creek near Four Buttes, Mont.	Middle Fork Poplar R. at Int'l Bdry.	*Middle Fork Poplar R. near Scobey, Mont.	East Poplar R. at Int'l Bdry.	Cow Creek at * Int'l Bdry.	East Poplar R. near Scobey, Mont.	* Poplar River near Fabia, Mont.	Poplar River near Poplar, Mont.
1931	246	45	6,300	48	686	2,340	3,740	2,640	82	3,630	6,930	14,400
1932	612	112	8,440	120	1,600	5,200	8,290	7,860	957	9,010	15,300	31,400
1933	1,900	344	15,200	369	3,040	9,320	15,000	5,710	625	8,890	25,000	50,200
1934	2,360	432	27,600	463	2,630	8,050	12,900	1,030	194	4,400	22,200	45,500
1935	300	54	6,190	56	1,660	5,540	9,140	5,340	629	8,870	20,600	42,700
1936	1,650	301	11,100	323	2,740	8,360	13,600	4,540	491	7,050	19,300	38,500
1937	206	37	4,740	40	826	2,660	4,350	2,860	134	7,150	21,100	42,000
1938	2,920	535	19,300	573	3,660	10,800	17,500	11,300	1,580	17,300	47,500	94,200
1939	9,580	1,760	57,100	1,880	8,200	22,000	36,500	16,500	2,540	19,400	74,700	147,000
1940	1,270	232	9,850	249	2,160	6,630	10,900	6,850	797	10,900	32,400	64,000
1941	1,640	298	9,360	319	3,310	10,300	16,700	9,950	1,310	15,900	25,300	50,000
1942	1,250	226	10,200	242	2,280	7,140	11,700	11,200	1,480	17,900	25,400	50,200
1943	6,760	1,220	54,900	1,310	10,500	32,000	51,300	25,200	3,960	41,700	112,000	221,000
1944	887	163	9,720	174	14,300	5,590	9,200	3,180	281	4,630	21,500	42,600
1945	2,400	440	20,400	471	2,550	7,170	11,900	5,340	539	8,230	32,300	63,500
1946	1,660	340	9,040	364	1,940	5,440	12,100	6,140	1,060	13,000	52,600	104,000
1947	1,120	206	15,200	220	3,540	11,600	18,500	16,700	2,860	30,800	38,900	76,100
1948	3,760	692	23,900	741	12,400	15,600	25,400	22,800	3,450	37,200	60,100	117,000
1949	391	70	6,230	75	1,520	4,910	8,010	8,060	1,040	12,800	21,100	41,000
1950	9,200	1,690	47,000	1,810	7,020	16,100	30,300	17,400	2,600	28,500	60,700	119,000
1951	5,790	1,060	33,900	1,140	3,940	9,900	16,800	10,900	1,060	16,400	45,500	88,300
1952	20,300	3,720	91,200	3,980	16,600	43,900	72,400	46,800	5,020	67,300	177,000	333,000
1953	2,800	510	24,100	547	5,420	17,100	27,500	8,460	1,020	13,200	40,500	79,200
1954	14,900	2,720	72,600	2,920	13,500	37,100	60,400	30,300	3,450	44,800	160,000	309,000
1955	8,580	1,570	47,700	1,690	10,100	29,200	47,400	37,800	2,260	43,300	90,100	175,000
1956	2,430	444	16,500	476	2,980	8,250	13,900	6,400	736	9,890	19,700	38,500
1957	587	106	8,590	113	1,260	3,960	6,670	4,770	353	6,800	16,900	32,400
1958	2,860	523	16,900	560	3,410	10,100	16,300	9,900	1,260	15,600	26,100	51,000
1959	954	172	10,600	184	1,210	3,540	5,790	3,830	250	5,570	27,500	53,800
1960	4,800	881	32,700	944	6,740	20,200	32,400	18,300	2,760	30,000	91,700	180,000
1961	115	20	5,790	21	811	2,670	4,380	5,160	475	7,650	12,900	24,600
1962	3,100	566	19,700	607	4,100	12,000	20,000	12,300	1,720	20,000	41,000	79,600
1963	5,450	999	39,800	1,070	9,710	30,000	47,900	10,700	1,250	17,000	42,500	82,800
1964	927	170	10,200	191	1,470	4,310	7,460	5,800	599	8,800	18,600	35,800
1965	1,350	247	13,600	265	1,960	5,890	10,200	9,840	1,330	15,800	29,900	57,200
1966	1,800	330	16,400	354	2,630	7,710	12,900	7,260	845	11,300	22,200	42,900
1967	7,790	1,420	42,100	1,530	7,050	19,100	32,000	19,400	2,970	32,500	82,500	162,000
1968	3,470	634	25,600	678	4,430	12,700	20,900	10,800	1,400	15,400	41,500	80,500
1969	10,400	1,910	50,000	2,040	9,510	25,800	43,000	21,000	3,250	34,900	118,000	231,000
1970	4,160	761	27,800	815	5,010	14,600	25,100	15,200	2,210	25,200	55,500	107,000
1971	1,990	363	14,200	389	2,320	6,680	11,900	12,900	1,830	21,200	27,200	51,000
1972	3,190	583	25,500	624	5,350	16,300	27,700	16,100	2,360	26,600	52,600	99,400
1973	859	155	10,100	167	1,140	3,340	6,590	4,030	274	6,300	15,300	27,300
1974	8,200	1,501	44,700	1,610	9,400	26,900	44,400	24,600	3,830	41,100	101,000	196,000
Minimum	115	20	4,740	21	686	2,340	1,740	2,640	82	3,630	6,930	14,400
Maximum	20,300	3,720	91,200	3,980	16,600	43,900	72,400	46,800	5,020	67,300	177,000	333,000
Mean	3,890	695	24,400	745	4,920	11,000	21,400	12,500	1,570	19,200	47,500	92,600

* Synthesized Flows as compared to other locations which had some recorded data although not necessarily for the complete period of record

VII. PROBABLE FUTURE SURFACE WATER USE

The probable future water use study was carried out to identify firm plans to use water in the Poplar River Basin during the period 1975 to 1985 and to provide some insight into potential demands for surface water after 1985. The intent of these investigations was to establish a basis for evaluating the impact of international apportionment of Poplar River streamflow on potential water uses in the basin.

The Poplar River Watershed is typical of the water deficient drainage systems in the region. In these areas, it is not uncommon for potential water uses to greatly exceed the availability of local runoff. Therefore, it is necessary to view and examine these potential water use projects within the context of available water supplies.

Scope of Investigations

Two levels of future water demands were defined; firm intent to increase water use in the basin during the period 1975 to 1985; and possible future use beyond that time. These potential water uses were identified under five categories as follows:

1. Domestic Use
   - by projecting historical water use and augmenting these estimates with information gathered during the resident surveys.

2. Irrigation Use
   - by projecting historical water use, by the resident surveys, and by evaluating the potential of irrigable lands. The water use [illegible] potential plans to irrigate lands on the Fort Peck Indian Reservation from the Poplar River, the Fort Peck storage capacity reservoir on the Missouri River, and from contemplated by the Fort Peck Tribes.

3. Municipal Use

   - by projecting the requirements of municipalities in the watershed which draw water from wells located adjacent to river courses in the basin.

4. Industrial Uses

   - by estimating the water requirements of industrial development in the basin that are presently proposed or represent future potential. In Saskatchewan, these potential demands are related to development of lignite coal deposits. Construction of a reservoir on the East Poplar River near Coronach is presently underway to supply water to a coal-fired thermal power plant. In Montana, a potential use for water has been identified related to potash mining near Scobey.

5. Wildlife Use

   - some potential exists for wildlife impoundments which may be constructed prior to 1985.

A detailed description of the studies carried out in Montana and Saskatchewan to evaluate these future water use demands is presented in Appendix C.

Results

Future water uses that have been identified in the Poplar River Basin in both Montana and Saskatchewan are summarized in Table 7. These estimates of future water use may not be totally indicative of the development potential in the basin as they have been based on available resource data. Future resource surveys may therefore affect these estimates. Furthermore, these potential uses exceed the available local runoff in many years, a factor which will act to limit future development.

Table 7a: Identified Future Water Requirements for the [illegible] Basin in Cubic Decameters

Type of Use	Saskatchewan Use Intents by 1985	Saskatchewan Additional Possible Future Use	Montana Use Intents by 1985	Montana Additional Possible Future Use
Domestic	148	-	[illegible]	-
Irrigation	271	-	80,050	[illegible]
Municipal	136	620	150	-
Industrial	10,238	81,400	8,630	-
Wildlife	370	-	-	-
TOTAL	11,163	82,020	89,[illegible]	[illegible]

Table 7b: Identified Future Water Requirements for the Poplar River Basin in Acre-Feet

Type of Use	Saskatchewan Use Intents by 1985	Saskatchewan Additional Possible Future Use	Montana Use Intents by 1985	Montana Additional Possible Future Use
Domestic	120	-	[illegible]	-
Irrigation	220	-	[illegible]	[illegible]
Municipal	110	500	[illegible]	-
Industrial	8,300	66,000	[illegible]	-
Wildlife	300	-	-	-
TOTAL	9,050	66,500	[illegible]	[illegible]

VIII. FLOW APPORTIONMENT AND ADMINISTRATION

Various apportionment alternatives were examined by the Task Force during the course of this study. These alternatives encompassed various percentage splits of streamflow on the tributaries and streams in the Poplar River Basin at the international boundary. Also, continuous minimum flows and short term volume releases in varying quantities were considered on the East Poplar River. The storage reservoir near Coronach, which is presently under construction, will facilitate this form of water delivery to the United States on the East Poplar. After these apportionment schemes were proposed, they were examined to determine their effect on both existing and future water uses in the basin. Desired modifications to these alternatives produced new apportionment alternatives during this formulation process until the Canadian and United States sections of the Task Force determined a mutually acceptable method of dividing the flows of the Poplar River.

Apportionment Recommendations

The Poplar River Task Force unanimously recommends that the waters of the Poplar River and its tributaries should be apportioned on the following basis:

A. The aggregate natural flow of all streams and tributaries in the Poplar River Basin crossing the international boundary shall be divided equally between Canada and the United States subject to the following conditions:

1. The total natural flow of the West Fork Poplar River and all its tributaries crossing the international boundary shall be divided equally between Canada and the United States but the flow at the international boundary in each tributary shall not be depleted by more than 60 percent of its natural flow.

2. The total natural flow of [illegible] in the Poplar River [illegible] shall be divided equally between Canada and the United [illegible] Specific conditions of this division are as follows:

a) Canada shall deliver to the United [illegible] percent of the natural flow of the [illegible] at the international boundary, as determined below the confluence of Goose Creek and Middle Fork.

b) The delivery of water from Canada to the United States on the East Poplar River shall be determined on or about the first day of June of each year as follows:

i) When the total natural flow of the Middle Fork [illegible] River, as determined below the confluence of Goose Creek, during the immediately preceding March 1st to May 31st period does not exceed 5,690 cubic decametres (4,800 acre-feet), then a continuous minimum flow of 0.028 cubic metres per second (1.0 cubic feet per second) shall be delivered to the United States on the East Poplar River at the international boundary throughout the succeeding 12 month period commencing June 1st. In addition a volume of 370 cubic decametres (300 acre-feet) shall be delivered to the United States upon demand at any time during the [illegible] month period ending June 1st.

ii) When the total natural flow of the Middle Fork [illegible] River, as determined below the confluence of Goose Creek, during the immediately preceding March 1st to May 31st period is greater than 5,690 cubic decametres (4,800 acre-feet), but does not exceed 9,000 cubic decametres (7,500 acre-feet), then a continuous minimum flow of 0.057 cubic metres per second (2.0 cubic feet per second) shall be delivered to the United States on the East Poplar River at the international boundary during the 12 month period June 1st through May 31st. In addition

of 0.028 cubic metres per second (1.0 cubic feet per second) shall then be maintained from September 1st through to May 31st of the following year. In addition, a volume of 617 cubic decametres (500 acre-feet) shall be delivered to the United States upon demand at any time during the 12 month period commencing June 1st.

iii) When the total natural flow of the Middle Fork Poplar River, as determined below the confluence of Goose Creek, during the immediately preceding March 1st to May 31st period is greater than 9,250 cubic decametres (7,500 acre-feet), but does not exceed 14,800 cubic decametres (12,000 acre-feet), then a continuous minimum flow of 0.085 cubic metres per second (3.0 cubic feet per second) shall be delivered to the United States on the East Poplar River at the international boundary during the succeeding period June 1st through August 31st. A minimum delivery of 0.057 cubic metres per second (2.0 cubic feet per second) shall then be maintained from September 1st through to May 31st of the following year. In addition, a volume of 617 cubic decametres (500 acre-feet) shall be delivered to the United States upon demand at any time during the 12 month period commencing June 1st.

iv) When the total natural flow of the Middle Fork Poplar, as determined below the confluence of Goose Creek, during the immediately preceding March 1st to May 31st period exceeds 14,800 cubic decametres (12,000 acre-feet) then a continuous minimum flow of 0.085 cubic metres per second (3.0 cubic feet per second) shall be delivered to the United States on the East Poplar River at the international boundary during the succeeding period June 1st through August 31st. A minimum delivery of 0.057 cubic metres per second (2.0 cubic feet per second) shall then be maintained from September 1st through to May 31st of the following year. In addition, a volume of 1,230 cubic decametres (1,000 acre-feet) shall be delivered to the United States upon demand at

c) The natural flow at the international boundary or at the mouth of the remaining individual tributaries shall not be depleted by more than 60 percent of its natural flow.

3. The natural flow and division periods for apportionment purposes shall be determined, unless otherwise specified, for periods of time commensurate with the uses and requirements of both countries.

Administration of Apportionment

The Poplar River Task Force recommends that a Poplar River Board of Control be appointed by the International Joint Commission to administer the apportionment agreement under the direction of the Commission and that the following terms of reference and responsibilities be considered:

Poplar River Board of Control

Membership

The membership of the Board of Control will consist of six members, two representatives from each country nominated by the Government of Canada and the United States respectively and one representative from each country nominated by the Governments of the State of Montana and the Province of Saskatchewan respectively. A co-chairman will be appointed by the International Joint Commission from each country and each co-chairman will preside at the meetings held in his country. A representative of the Poplar River Group (see Page 36) will be one of the two representatives nominated by the Governments of Canada and the United States.

Meetings

The Board of Control will meet as required.

Reports

The Board of Control will prepare an annual report for the International Joint Commission on all activities and findings related to the

the water division computations and estimates, describe any problems which have arisen and make recommendations on matters outside the delegated responsibilities of the Board of Control.

Network Design and Computation Methods

The Board of Control will be responsible for the design of the stream gauging and other monitoring networks including location, frequency of observation and standards necessary to carry out the division of the water under the terms of the apportionment agreement. It will also be responsible for determining when and where indirect methods of calculating depletions and runoff are sufficient.

Division Periods for Water Deliveries

The Board of Control will be responsible for determining division periods for natural flow computations when it becomes necessary to divide the waters of the streams and tributaries crossing the international boundary because of increasing levels of depletion in the upstream country.

Schedule for Water Deliveries on East Poplar River

The Board of Control shall determine the rules and procedures to be used in meeting the requirements for the volumetric releases to the United States on the East Poplar River. Consideration shall include minimum notification for the release, scheduling, monitoring and liaison contacts.

Disagreements

In the event of disagreement between the two sections of the Poplar River Board of Control, the matters in controversy shall be referred to the International Joint Commission for decision.

Other Considerations

Monitoring Agencies

The Poplar River Task Force further recommends that the monitoring agencies be the Water Resources Division, United States Geological Survey, Department of the Interior and the Water Survey of Canada, Environment Canada.

Data Collection

First class streamflow stations, equipped with [illegible] designed specifically to provide accurate streamflow record in the [illegible] flow ranges, be constructed on the East Poplar River at the international boundary and the Middle Fork Poplar River below the confluence [illegible]

A continous record of flows will be maintained on the East Poplar River at the international boundary on a year round basis. As a minimum, a continuous record of flows will also be maintained on the Middle Fork Poplar River below the confluence with Goose Creek from March 1 to May 31 each year as the derivation of natural flows for this period are necessary to define water delivery to the United States on the East Poplar.

Methods of Calculation

The method of computation of natural flow should be governed to some extent by the level of depletion in the basin with a view to minimizing monitoring requirements and computational effort. The methods of calculation should be periodically reviewed by the Poplar River Board of Control and altered when required for efficient administration of the apportionment agreement. General concepts that should be adopted have been identified and are listed below:

1. The natural flow at the international boundary of any tributary or stream will be determined by adding the upstream depletions to the recorded or estimated flow at the international boundary.

2. Water use in those portions of the basin which contribute to streamflow crossing the international boundary less often than once in two years will not be considered as a depletion in the computation of the natural flow.

3. Depletions for minor domestic projects will be excluded from determination of natural flow unless the diversion for all these uses exceeds one percent of the average natural flow for any stream or tributary at the international boundary.

4. Indirect estimating procedures will be used to determine the flow in tributaries or streams crossing the international boundary where depletions in the upstream country are significantly less than the limits specified in the apportionment agreement.

IX. DISCUSSION

Impact of the Proposed Apportionment

The proposed apportionment of Poplar River flow will affect both the availability and the distribution of streamflow in Canada and the United States. The intent is to allow more orderly development of the water resources in both countries so that each country has a firm knowledge of what portion of the natural flow can be developed within its jurisdiction.

Requirements of the two countries have been met by specific recommendations on individual streams. A base flow will be maintained on the East Poplar River where under natural conditions the flow at the international boundary occasionally dropped to zero. In addition to the base flow, provision is made for releases on demand each year to satisfy special needs in Montana. Canada, in turn, will have the right to store a greater percentage of larger flows on the East Poplar River for future consumptive use.

The numerical effect of the recommended apportionment is listed in Table 8 for two conditions. The first condition describes the effect at Canada's present level of development. The second condition describes the flow that would occur with one 300 megawatt thermal power plant operating at the proposed Saskatchewan Power Corporation reservoir on the East Poplar River near Coronach and the existing level of development on other streams.

Discussion of the proposed apportionment would not be complete without some mention of the impact it would have at two downstream locations in the Poplar River Basin - Poplar River near Scobey and Poplar River near Poplar. The aggregate effect of present Canadian diversions on flow of the Poplar River near Scobey (below the confluence of the East Poplar River and the Middle Fork Poplar River) is 1,200 cubic decametres (970 acre-feet). This represents an average reduction in natural flow of 1 percent. Similarly the Saskatchewan Power Corporation proposal for one additional 300 megawatt unit would reduce average natural flow by 10 percent.

Table 8: The Impact of Canadian Diversions on Poplar River Annual Flows

	Mean Flow Year		Maximum Flow Year		Minimum Flow Year	
	dam^3 (acre-ft)	% of Natural Flow	dam^3 (acre-ft)	% of Natural Flow	dam^3 (acre-ft)	% of Natural Flow
Present Level of Canadian Use						
East Poplar @ Int'l Boundary	14,200 (11,500)	92.1	56,900 (46,100)	98.6	2,330 (1,890)	71.5
Middle Fork @ Int'l Boundary	15,800 (12,800)	98.6	54,000 (43,800)	99.6	2,670 (2,160)	92.3
West Fork @ Int'l Boundary	4,400 (3,560)	93.8	24,700 (20,100)	99.0	73 (59)	51.3
Poplar R. nr. Scobey	48,800 (39,600)	97.6	171,000 (139,000)	99.3	7,950 (6,440)	87.4
Poplar R. nr. Poplar	112,000 (91,100)	98.4	409,000 (332,000)	99.6	16,400 (13,300)	92.1
Assuming Present Canadian Use Plus the East Poplar Reservoir near Coronach with One 300 MW Unit						
East Poplar @ Int'l Boundary	7,620 (6,170)	49.5	52,700 (42,700)	91.3	1,260 (1,020)	38.7
Middle Fork @ Int'l Boundary	15,800 (12,800)	98.6	54,000 (43,800)	99.6	2,670 (2,160)	92.3
West Fork @ Int'l Boundary	4,400 (3,560)	93.8	24,700 (20,100)	99.0	73 (59)	51.3
Poplar R. nr. Scobey	42,300 (34,300)	84.4	166,000 (135,000)	96.4	6,870 (5,300)	75.6
Poplar R. nr. Poplar	106,000 (85,800)	92.7	404,000 (328,000)	98.4	15,300 (12,400)	86.1
Spillage from East Poplar Reservoir with One Unit (Spills in 16 Years)						
	5,320 (4,310)	34.5	39,800 (32,300)	69.0	0	0

When these effects are extended downstream to the United States near Poplar, the present reduction is [illegible] per cent of natural flow. The Saskatchewan Power Corporation proposal with one 300 megawatt unit, combined with present Canadian uses, reduces natural flow by [illegible] per cent. These estimates have been quantified in more detail in Table [illegible].

East Poplar River Deliveries to United States

The recommended apportionment includes a variable base flow and volume delivery on East Poplar River which reflects hydrologic conditions and attempts to meet the needs of Montana while minimizing the effect on the firm water supply available from the East Poplar Reservoir near Coronach. The Middle Fork Poplar River is used as an index to determine the deliveries to the United States on the East Poplar River because of the similar characteristics of the two streams and relative ease in determining natural flow of the Middle Fork Poplar River. The determination of natural flow on the East Poplar River at the international boundary is made difficult by the large number of small existing uses and anticipated complications in determining use from the proposed East Poplar Reservoir near Coronach.

Estimates have been made of the frequency of occurrence of the four flow conditions for delivery of water to the United States in the East Poplar River under provisions of the apportionment agreement. Based on 44 years of streamflow record these estimates are:

Less than 4,690 cubic decametres (less than 3,800 ac.ft.) - [illegible] of the time
4,690 - 9,250 cubic decametres (3,800 - 7,500 ac.ft.) - [illegible] of the time
9,250 - 14,800 cubic decametres (7,500 - 12,000 ac.ft.) - [illegible] of the time
Exceeds 14,800 cubic decametres (exceeds 12,000 ac.ft.) - [illegible] of the time

Other Considerations

Two important questions related to the matter of apportionment, but not specifically within the terms of reference of the Committee, were brought to its attention.

Interim Apportionment

The Canada-United States bilateral meeting held in April 1975 requested the Governments of Saskatchewan and Montana to discuss and develop recommendations for apportionment of East Poplar River waters during the filling period of the Saskatchewan Power Corporation reservoir on the East Poplar River near Coronach, Saskatchewan. It is the view of the Task Force that the immediate implementation of the recommended long-term apportionment would decrease the probability of filling that reservoir to the required operating level (elevation 749.0 m or 2,457 ft.) by 1979. The Task Force recommends that consideration be given to interim apportionment during the filling period of the East Poplar Reservoir near Coronach.

Water Quality

Water Quality was discussed at the Canada-United States bilateral meeting in April, 1975. Agreement has been reached on a monitoring program which will provide needed information on existing water quality and on any changes that may occur as a result of changes in flow regime, reservoir control, and development. The Task Force was informed of the commitments of the Government of Saskatchewan and the Saskatchewan Power Corporation pursuant to the licence issued by the Minister of Environment, Government of Canada under the International River Improvements Act. Water quality was a consideration in framing the recommendations of the Task Force on minimum flow requirements on the East Poplar River at the international boundary. However, during the course of the studies it has become apparent that water quality impacts of apportionment of the waters in the Poplar River Basin require assessment. The apportionment will allow substantial use and reduction of the flow of the East Poplar River. The water quality effects of a change in the flow regime are unknown. The Task Force recommends that consideration continue to be given to the water quality implications of the proposed apportionment.

The United States section of the Task Force recommends several studies should be undertaken to the mutual benefit of both countries. In general these studies should be directed toward analyzing the effects of changes in flow regime, reservoir control and planned large-scale development as listed on the following page:

a) An investigation of the water quality impacts related to the changes in flow regime of the Poplar River and changes in water quality related to proposed developments and depletions on surface and groundwater.

b) Data being collected by Saskatchewan concerning the effects of strip-mining coal on the quality and levels of groundwaters in the vicinity of the mine and possible downstream impacts should be made available to the study for analysis.

c) Future expansion of the proposed facility may involve the importation of water from an external basin or from outside of the Poplar River Basin. Impacts of this importation should be included in the investigation.

The Canadian Section of the Task Force held a different view. The matter of water quality is under consideration by the two governments, data collection was initiated in 1974, and a long-term monitoring program has been approved. Additional studies will be carried out when an adequate data base is available. The Canadian Section does not feel qualified to state specifically what studies or types of studies are required.